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(54) A method of indicating the presence of an impregnant  
(57) The presence of an impregnant, e.g. an antimicrobial composition, in cloth is indicated by means of a dye to provide visual evidence of the continuing activity of the impregnant. The antimicrobial composition in the cloth is activated on contact with a liquid such as water and is ionically bonded to the cloth. Portions of the impregnated cloth are dyed with an indicator dye which bonds preferentially to the antimicrobial composition so that when the antimicrobial composition is exhausted, the dye will disappear from the cloth. The dye is preferably applied to the cloth in stripes.

## SPECIFICATION

## A method of indicating the presence of an impregnant

5 The invention relates to a method of indicating the presence of an impregnant in a substrate and more particularly, but not exclusively, to a method of indicating the presence of an antimicrobial compound 10 impregnated into a substrate of cloth. The term "cloth" used in the specification and claims is intended to include paper and other non-woven materials as well as woven or knitted textile fabrics. Furthermore "cloth" is intended to cover naturally 15 occurring materials such as animal skins.

It is well known that cloths, towels and the like used for wiping soiled surfaces or drying potentially contaminated surfaces present a hygiene hazard in that with repeated use they may cause, by virtue of 20 themselves becoming increasingly contaminated, the spread of harmful active or potentially active micro organisms.

It is known to provide a wiping cloth typically of a viscose non-woven fibre material impregnated with 25 an anti-microbial compound, which may be used for wiping and drying surfaces and by the use of which the spread of active micro organisms is at least reduced causing less risk to public health, the anti-microbial activity of such a cloth being released on 30 contact of the cloth with a polar liquid, such as water. A major disadvantage of the known cloth is that it is impossible to predict when the useful antibacterial life of the impregnated cloth has come to an end. This disadvantage is, of course, true of the use of 35 disinfectants generally.

It is an object of the invention to mitigate this disadvantage.

According to the invention there is provided cloth comprising a substrate impregnated with an agent, 40 at least in part ionically bonded to the substrate, which agent is activated by contact with a polar liquid, a portion of the impregnated substrate having applied thereto a dye of a kind which will bond ionically to the impregnant substantially more than to 45 the substrate. The impregnant may be a deodouriser, a corrosion-inhibitor, an antimicrobial compound or the like. That a suitable cloth-impregnant-dye system has been selected can be verified by a simple procedure. A length of suitable unimpregnated cloth is impregnated in longitudinal stripes with a proposed impregnant. After drying where necessary, the stripe impregnated cloth is dyed all over by immersion in a suitable dye bath. The dyed cloth is then flushed with a large quantity of water 55 and a suitably selected system will be seen to retain the dye substantially only on the impregnated stripes.

Preferably the impregnant is uniformly dispersed over the substrate, and preferably the dye is applied 60 to the substrate in stripes. It is however possible to apply the dye to the substrate in other configurations such as dots.

Thus in one embodiment the invention provides cloth having visual indication of the presence of an 65 antimicrobial compound impregnated therein, the

cloth consisting of a mechanically strong viscose non-woven substrate, the anti-microbial compound being cationic and at least in part ionically bonded to the substrate and possessing bactericidal properties

70 on contact with a polar liquid, the impregnated substrate having an anionic dye applied to a portion thereof so that it bonds ionically to the impregnant but not to the cloth and so that a significant portion of the impregnated fabric remains undyed, as it will 75 probably be that the active property of the impregnant will be adversely affected by reaction and combination with the dye.

From another aspect the invention provides an article comprising cloth as defined above, e.g. dis-

80 posable clothing such as underwear, combat uniforms or surgeons' gowns or foot mats e.g. for preventing the spread of infection in public swimming baths or disposable bedding. The cloth substrate is preferably of cellulosic material such as

85 natural cellulose, viscose, esterified viscose or oxycellulose since such materials are useful in forming textile cloth of many different kinds and also bond well to cationic anti-microbial compounds. However many polymeric materials, while in general

90 being less hydrophilic than cellulosic materials or even hydrophobic nevertheless bond to cationic anti-microbial compounds and are appropriate in some circumstances to form cloth substrates. Suitable polymers include polyamides, polyesters,

95 polyacrylonitriles, polyvinylalcohol, polyvinylacetate, polypropylene, polyethylene and polyurethane. Furthermore naturally occurring materials such as wool and animal skins might be suitable as cloth substrates.

100 The antimicrobial compound may be selected from those groups which are soluble in water and exhibit cationic character in their aqueous solutions. Suitable groups include quaternary ammonium compounds, bisguanides, antimicrobial amphoteric

105 surfactants, and mixtures thereof. Examples of suitable quaternary ammonium compounds are alkyl dimethyl benzyl ammonium chlorides e.g. alkyl dimethyl ethyl-benzyl ammonium chloride, and benzalkonium chloride. Alternatively the quaternary

110 ammonium compound may be an alkyl trimethyl ammonium bromide, cetyl pyridinium chloride, or benzethonium chloride. Suitable alkyl groups in such compounds contain predominantly straight chain C<sub>12</sub> to C<sub>18</sub> groups. An example of a suitable

115 bisguanide is a soluble salt of 1,6-di-(4-chlorophenyl-disguanido hexane) or a polymeric bisguanide such as Vantocil. (Registered Trade Mark). An example of a suitable amphoteric surfactant is dodecyl-di-(aminoethyl) glycine.

120 Examples of preferred antimicrobial compounds for use in the present invention are:—

(a) A 1:1 mixture of ADBAC (alkyl dimethyl benzyl ammonium chloride) and CTAB (cetyl trimethyl ammonium bromide) dissolved in water and isopropanol to 50% active concentration and applied to

125 the cloth in a further dilution of 1 part composition in 5 parts of water.

(b) Similarly a 1:1 mixture of CTAB and chlorhexidine gluconate (the gluconate salt of 1,6-di-(4-

130 chloro-phenyl)disguanido hexane).

(c) Similarly a 1:1 mixture of ADBAC and a polymeric bisguanide (such as that sold by I.C.I. under the trade name Vantocil).

(d) Similarly a 5:2 mixture of ADBAC and Vantocil dissolved in water to 35% activity.

5 (e) Similarly a mixture of 30 parts by weight CTAB dissolved in 100 parts by weight of a 20% aqueous solution of polymeric bisguanide (Vantocil).

The substrate cloth may be impregnated with the 10 anti-microbial compound or mixture of compounds in any convenient way. Thus for example the anti-microbial compound may be dissolved or dispersed in a suitable liquid vehicle, preferably water, and the solution or dispersion applied to the cloth, for example by dipping or spraying. After such treatment the 15

cloth may, if necessary, be dried to the extent that it is dry to the touch, and may undergo such secondary converting operations as are appropriate to the desired end function, e.g. slitting, cutting, folding, 20 making up into garments, etc. As an alternative the impregnant might be incorporated in the yarn from which the cloth is to be woven, before weaving. That the cloth has been suitably impregnated with an antimicrobial compound and that the impregnant 25 is effectively released to perform its function is readily ascertained by a zone of inhibition test such as the relevant AATCC procedure or a similar variation. A typical result obtained showed that cloth impregnated in accordance with the present invention performed as follows:

Cloth	Impregnation level of the mixture of Example (e)	Effectiveness as shown by zone of inhibition (Diameter in mm)
50 grammes per square metre non-woven textile fabric comprising 51% viscose rayon 20% cellulose pulp and 29% acrylic binder.	9300 ppm	(a) Staph aureus 25 mm. (b) E coli 6mm.

The cloth which has been impregnated more or less uniformly with an effective antimicrobial compound is then dyed over a portion of its surface area with a suitable dye, i.e. a dye which bonds preferentially to 35 the impregnant but does not form a significant bond with the unimpregnated cloth, such that it is an important characteristic of the overall system that the dye, and/or any dye-antimicrobial combination present is released (on contact with a polar liquid) at 40 least as quickly and preferably somewhat more rapidly than impregnant which is not in combination with the dye, thereby serving as an indicator of the longevity of the effective antimicrobial life of the impregnated cloth. That such an indication system is 45 effective may readily be discerned by performing zone of inhibition tests during the working life of the

cloth, particularly just before and just after disappearance of the indicator colour.

In a preferred embodiment of the invention, the 50 indicator system takes the form of thin stripes, and the disappearance of these stripes during use either as a result of rinsing, soaking, wiping or contact with incompatible materials serves to give an indication of the antimicrobial end-point of the product.

55 Suitable dyes would be water soluble dyes of substantially anionic character in solution. As the wiping cloth which is a preferred embodiment of this invention is largely intended for use in food related areas, preferred dyes are those which are deemed safe as food additives.

60 Exemplary dyes are as follows:—

Dye	B.S. Number	E.E.C. Number	F D & C Number	Colour index Number
Sunset Yellow FC	3340	110	Yellow 6	15985
Blue X	4143	132	Blue 2	73015
Blue FCF	—	—	Blue 1	42090
Green S	4153	142		44090
Amaranth	3341	123	Red 2	16185
Vi let BNP	—	—		—
Ponceau 4R	3342	124		16255
Carmoisine	3343	122		14720
Geranine 2G	3611	—		18050

Ancillary material, e.g. preservatives such as benzoic acid may be added to the dye or dye mixture if desired.

CLAIMS

- 5 1. Cloth comprising a substrate impregnated with an agent, at least in part ionically bonded to the substrate, which agent is activated by contact with a polar liquid, a portion of the impregnated substrate having applied thereto a dye of a kind which will bond ionically to the impregnant substantially more than to the substrate.
- 10 2. Cloth according to claim 1, in which the impregnant is an antimicrobial composition.
- 15 3. Cloth according to claim 1 or claim 2, in which the impregnant is uniformly dispersed over the substrate.
- 20 4. Cloth according to any one of claims 1 to 3, in which the dye is applied to the substrate in stripes.
- 25 5. Cloth according to any one of claims 2 to 4, in which the antimicrobial composition exhibits cationic character when in aqueous solution.
- 30 6. Cloth according to claim 5, in which the antimicrobial composition is selected from the group consisting of quaternary ammonium compounds, bisguanides, antimicrobial amphoteric surfactants, and mixtures thereof.
- 35 7. Cloth according to claim 6, wherein the quaternary ammonium compound is an alkyl dimethyl benzyl ammonium chloride.
- 40 8. Cloth according to claim 6, wherein the quaternary ammonium compound is benzalkonium chloride.
- 45 9. Cloth according to claim 6, wherein the quaternary ammonium compound is a member of the group consisting of alkyl dimethyl ethyl-benzyl ammonium chloride, alkyl trimethyl ammonium bromide, cetyl pyridinium chloride and benzethonium chloride.
- 50 10. Cloth according to claim 8, wherein the alkyl group in the quaternary ammonium compound is a straight chain group predominantly in the range C<sub>12</sub> to C<sub>18</sub>.
- 55 11. Cloth according to claim 6 wherein the bisguanide is a soluble salt of 1,6-di-(4-chlorophenyl)diguanido hexane).
- 60 12. Cloth according to claim 6, wherein the bisguanide is a polymeric bisguanide.
- 65 13. Cloth according to claim 6, wherein the amphoteric surfactant is dodecyl-di-(aminoethyl) glycine.
- 70 14. Cloth according to any preceding claim, wherein the impregnant is an antimicrobial composition according to any one of the examples.
- 75 15. Cloth according to any preceding claim, wherein the substrate is of cellulosic material.
- 80 16. Cloth according to claim 14, wherein the cellulosic material is fibrous.
- 85 17. Cloth according to claim 15, wherein the substrate is non woven.
- 90 18. Cloth according to any preceding claim, comprising a dye selected from any one of the examples.
- 95 19. An article comprising cloth as claimed in any preceding claim.
- 100 20. A wiping cloth having visual indication of

antimicrobial activity comprising a non-woven fibrous viscose substrate impregnated with an antimicrobial mixture comprising 30 parts by weight CTAB dissolved in 100 parts by weight of a 20% aqueous solution of polymeric bisguanide, the impregnant being at least in part ionically bonded to the substrate and being activated on contact with a polar liquid, the impregnated substrate having lines of an anionic dye applied thereto such that the dye bonds ionically to the impregnant substantially more than to the substrate.

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